CONCEPT OF OPERATIONS

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1. Introduction

The Technical Operations Services (ATO-W) Concept of Operations (ConOps) defines the principles of operation for the organization that manages and maintains the National Airspace System (NAS) infrastructure. The Air Traffic Organization's (ATO) goals of safety, increasing efficiency, reducing costs, and being customer centric serve as the foundation upon which this document is based.

2. Purpose

The ConOps is a future vision outlining best business processes for managing the Service Area's resources, personnel, and programs. This document is intended to provide a framework to guide policy decisions and implementation efforts. This document replaces Airway Facilities ConOps for the Future, dated March 1995. In order to ensure productivity gains are realized and accommodate future agency direction, ATO-W will periodically review and update the ConOps. This review will emphasize efficiencies in our work to meet the expectations of the owners, customers, and employees.

3. Scope

This document is based on a framework of seven topics addressing the key business practices that require renewal:

- *Maintenance Philosophy to Support Operations* – Provides a definition of what the maintenance philosophy encompasses.
- *Reliability Centered Maintenance (RCM)* – An optimal mixture of maintenance approaches based on technology.
- *Workforce Structure* – Describes the organization's elements.
- *Control Centers* – Defines management of the NAS.
- *Service, System, and Subsystem Certification* – An overview of a new certification approach.
- *Employee Credentialing and Proficiency* – A process on how technical specialists are developed, credentialed, and maintain proficiency.
- *Metrics* – Internal and external measurements related to organizational performance.

The above topics are elemental aspects of the organization's mission. To ensure that the changes in policy and business processes do not negatively affect safety, the Safety Management System (SMS) process will be followed.

4. Maintenance Philosophy to Support Operations

The maintenance philosophy of ATO-W emphasizes use of credentialed specialists to assure effective and economical maintenance of NAS assets. The primary goal is to provide expected levels of service availability with minimal equipment related delays at an acceptable cost. Strategic use of remote monitoring technology, establishment of customer priorities, and centralized control centers (CC) will promote timely mobilization of technical resources based on pre-established response requirements. Reliability Centered Maintenance (RCM), based on an analysis of equipment characteristics and failure information, will ensure that an optimal mix of maintenance approaches is used.

The first line technical work force will be capable of accomplishing the majority of maintenance and corrective activities, with only occasional technical support from a centralized Service Area office and/or National Engineering experts. Field supervisors and specialists will focus on core functions (e.g., maintenance, certification, technical documentation, modifications, etc.) and initiatives placing an administrative burden on individuals performing field work force will be avoided.

5. Reliability Centered Maintenance (RCM)

RCM is an ongoing process that gathers facility performance data and uses it to improve design and future maintenance practices, resulting in the most effective approach to maintenance. This time-proven concept combines the optimal mix of time or calendar-based (periodic) actions, non-routine actions, or a run-to-fault (RTF) strategy. Rather than apply these strategies independently, they are integrated to take advantage of their respective strengths.

5.1 Overview

RCM uses performance analysis, periodic maintenance (PM), predictive testing and inspection (PT&I), repair (also called reactive maintenance), and proactive maintenance techniques in an integrated manner to increase the probability that a system or component will function as expected over its life cycle. This approach ensures NAS components can provide their intended functional capability and produce a NAS infrastructure service for NAS users with the required reliability, availability, and accountability at the lowest cost.

RCM requires that maintenance decisions be based on maintenance requirements supported by sound technical and economic justification. As with any philosophy, there are many paths which lead to a final goal. This is especially true for RCM where the consequences of failure can vary dramatically.

Risk assessment techniques and system evaluation processes will be required to determine the appropriate maintenance philosophy to be employed. Assessment and evaluation considerations need to take into account the specific maintenance

task (e.g., intrusive or non-intrusive activities), external and internal monitoring capabilities, automatic shutdown/transfer features, NAS system criticality, and equipment/service redundancies. This rigorous approach ensures that the maintenance program focuses on those maintenance activities that add value and will protect both the equipment and the services they provide.

The NAS uses equipment that spans many generations of mechanical, visual, and electronic technologies (e.g., vacuum tubes, transistors, integrated circuits, and microprocessors). Equipment maintenance requirements should be consistent, reflect the type of technology employed, and in general should not be location specific. Mechanical and pre-solid state electronic technologies typically require a structured periodic maintenance approach and philosophy. State of the art, second and third generation based electronics, including integrated circuit, or microprocessor based technologies may be best suited to a reactive or an occurrence driven maintenance philosophy. Maintenance approaches will continue to change as a result of environmental conditions, equipment age and architecture, power quality, etc.

5.2 Periodic Maintenance

There are three types of maintenance tasks in a periodic maintenance program: Preventative Tasks, Routine Tasks, and Performance Checks. Buildings, roads and grounds, and infrastructure support systems require preventative maintenance intervals adjusted for geography and seasonal requirements to protect these investments. Electro-mechanical, environmental, batteries, and legacy tube or transistor systems or sub-systems need to reflect a maintenance program based on scheduled intervals, hours of operation, or miles as recommended by the manufacturer or existing maintenance orders to minimize total cost of ownership (TCO). Routine tasks include activities such as house keeping, updating documents, logging, etc. Performance checks are used to document continued satisfactory operation on equipment that occasionally requires adjustment to prevent interruption of service.

5.3 Aperiodic Maintenance

Second and third generation electronic systems or sub-systems that are digital, solid state, or microprocessor based are best adapted to a maintenance approach triggered by occurrences, observations, or concerns.

5.4 Maintenance Concept Determination

The selection of appropriate maintenance activities for NAS systems will continue to be accomplished through the issuance of new and updated system-specific maintenance technical handbooks. The primary focus of this ongoing effort will be the refinement of maintenance strategies that will minimize the total cost of ownership (TCO) while assuring required availability. This refinement of the maintenance program will be accomplished by trained engineers and specialists utilizing industry-standard RCM principles and practices.

5.4.1 Engineering Analysis

FAA systems vary widely in terms of use, design, complexity, age, architecture, and robustness. In spite of this, a standard general approach may be taken in determining a system optimized approach to maintenance. Typical tasks will include:

- Analysis of data to find lowest replaceable unit (LRU) failure trends & causes.
- Determination of the effect of failures on system operation, the maintenance actions that could have prevented or delayed the failure, and the monitoring or testing that can be performed to predict failures.
- Definition of appropriate periodic maintenance tasks necessary to prevent premature failure, where a positive correlation exists. Examples of such tasks include brush replacement in electrical motors, oil replenishment/replacement in gear drives, and visual inspection to determine needed replacement of hoses in circulation systems.
- Analysis of those systems or LRUs which exhibit component operating drift over time. This will determine the necessary monitoring or testing frequency to prevent system degradation and failure.
- Identification of systems or LRUs which have NO maintenance activity or monitoring that can predict or prevent failures. In addition, if the risk of failure is acceptably low, or if sufficient mitigation or fault tolerance is available, a Run-to-Fault maintenance program can be adopted.
- Incorporation of information from a formal feedback process to adjust required or recommended maintenance.

5.4.2 Considerations

Determining the appropriate maintenance method for each facility and equipment type should consider:

- System Technological Standing (i.e. 1st, 2nd, 3rd Generation).
- Levels of Redundancy
- Automatic Transfer features
- Remote Monitoring and Control (RMC)
- System Criticality
- Risk assessment and tolerance
- Risk versus cost
- Best maintenance practices
- Electro-Mechanical characteristics

- Environmental conditions

5.4.3 Conceptual Example of Analysis

The table below illustrates possible maintenance approaches:

Systems	Seasonal/As Required	Periodic Interval	Aperiodic
Buildings, Roads & Grounds	x		
Electro-Mechanical		x	
Environmental		x	
Batteries		x	
Legacy Electronics (1st Gen)		x	
Digital/Solid State/Integrated Circuits		x	x
Microprocessor Based			x

5.4.4 Validation of Maintenance Approach

When major maintenance changes for existing equipment types are proposed, they should be tested on a sample basis before NAS-wide implementation. Test sites should be selected to include challenging environmental conditions such as seasonal temperature and humidity extremes, and other operational factors such as traffic density.

If an existing system type is converted from periodic maintenance to a run-to-fault maintenance concept, the decision will be validated upon initial implementation by annual measurements of important operational characteristics until sufficient engineering data is collected to verify appropriateness.

5.5 Technical Documentation and Logging

The on-site Technical Performance Records (TPR) are a valuable facility resource for trend analysis and should continue in their current basic format. As tools improve and advance, TPRs will evolve into an electronic format.

Logging is a historical record of system maintenance activities. Technological improvements are required to decrease the time needed to log NAS data. Multiple solutions are being studied, ranging from bar code readers and hand held devices to centralizing logging.

5.6 Corrective Maintenance and Restoration Priorities

Corrective maintenance actions by field specialists result in partial or complete restoration of NAS equipment, services, or facilities. Operational abnormalities which may require corrective maintenance are caused by unanticipated component failures, equipment malfunctions, electrical power outages, or other unplanned causes. Discovery of abnormal operating conditions is made by notification from pilots, airport operators, air traffic control, or direct observations

by technical specialists. In addition, strong emphasis will be placed on remote status monitoring at Control Centers (i.e., OCC/SOC) as a means of discovering abnormal conditions, impending severe weather events, or other factors affecting equipment performance.

Once an abnormal condition has been discovered, it will be reported immediately to the service Control Center (CC) to start the restoration process. Response goals will be established based on *customer expectations* and translated into restoration scenarios with differing response times. The CC must have effective communication with air traffic control systems operations personnel for real-time validation of response priority (e.g., weather conditions in certain locations may necessitate more expeditious response times in order to mitigate potential delays, etc.). After field personnel have been notified, the CC will accomplish upward status reporting to designated management and technical support personnel. CCs will maintain real-time status reporting and notification of external users of services throughout the duration of the event.

Prioritization of response will be based on factors such as:

- Importance of the airport or air traffic control facility that is directly or indirectly affected by the equipment or service outage (e.g., OEP Airport, HUB Airport, ARTCC, etc.)
- Criticality of the service or equipment
- Redundancy of equipment, coverage, or service
- Assessment of safety or risk factors created by the outage condition
- Value-based perspective of cost for restoration actions, including personnel deployment, parts, outside services, and other factors
- Political, military, or National Security considerations

Response is accomplished according to customer requirements and specified in service level agreements (SLA). Dispatch of maintenance responders is accomplished by the CC utilizing tiered prioritization scenarios. The table below is notional and illustrates possible Maintenance Response Times.

Response Priority	Response Time
1	Immediate (up to 30 minutes)
2	Immediate Dispatch (up to 4 hours)
3	Dispatch Specialist (up to 24 hours)
4	Dispatch Specialist (up to 96 hours)

Restoration activities following response are accomplished by System Specialists, CC Specialists, or non-FAA personnel including military, other governmental agencies, or outside vendors. The specialists will log their activities and notify the CC, which will close the event in the appropriate log.

6. Workforce Structure

Successful service delivery is dependent upon field technical specialist and supervisors (i.e., Service Support Center) who are focused on the quality control programs (QC) that comprise our core functions. Non-core support, administrative, and related activities will be provided by other organizational entities. Any initiatives outside of core functions that place an administrative burden on individuals performing field work are to be avoided. Tools and technologies will be utilized to assist technical specialists and increase their productivity.

6.1 Core Functions

The following quality control (QC) programs represent the primary work of the field organization (i.e., core functions):

- *Certification* (i.e., Services, Systems, Subsystems): The credentialed technical specialist accomplishes certification as required.
- *Logging* (i.e., Control Center Log and content of Facility Maintenance Log): The technical specialist documents work performed at the field level and inputs information into appropriate logs.
- *Maintenance* (e.g., RCM and Corrective Maintenance): The technical specialist accomplishes periodic maintenance and restoration activities.

- *Modification* (e.g., Installation and Documentation): The technical specialist accomplishes modifications and documents completion.
- *Technical Documentation* (e.g., Handbook changes, Technical Performance Records, Facility Reference Data File): The technical specialist records data specific to the facility.

The field organization is comprised of four types of FAA employees – trades or skilled labor (e.g., infrastructure and supportive facilities), 2101 technical specialist (e.g., NAS facilities and equipment), technical support staff, and CC staff.

Organizational Functions	Tasks/Roles (Not all inclusive)
Trades and Skilled Labor	Support facilities (e.g., roads, grounds, and structures) and less complex maintenance.
Technical Specialists	Accomplish RCM, corrective maintenance, and certification on NAS service-producing equipment
First Level Technical Support	Accomplish/assist in advanced maintenance requirements (atypical or complex corrective maintenance or tasks)
Control Centers	Management of the NAS, Service certifications, coordination, response prioritization, documentation of NAS activities, dispatch, Remote Monitor and Control

6.2 System Service Center (SSC)

The primary role of the System Support Center is to focus on the accomplishment of core functions. Non-core support functions and related program management will be provided by other organizational elements within the Service Area (SA) or Headquarters organizations. SSC structure and workload assignments allow for technical specialization at locations where clusters of like systems and equipment types exist.

Field managers have the flexibility to accomplish maintenance activities on support facilities (e.g., roads, grounds, and structures) or less complex electrical and mechanical facilities utilizing trades-persons and skilled labor. Other administrative and logistical workload remaining in the SSC should be accomplished by administrative support personnel.

6.3 First Level Technical Support

The First Level Technical Support organization (e.g., Specialists-In-Depth) provides assistance with restoration activities and enhancement of facility performance. Technical Support Specialists are responsive to system or equipment anomalies that are beyond the SSC's technical or resource capabilities. In order to be responsive to SSC needs, it is imperative that the First Level Technical Support organization be:

- Focused on facility performance, complex outage restoration, facility optimization, new installations etc.
- Positioned as closely to the service delivery point as possible (i.e., dispersed geographically to satisfy local operational needs).
- Capable of supporting *all* technical specialties.
- Networked across functional and organizational boundaries (i.e., within the same Service Area)

6.4 Second Level Technical Support

This level of support will be provided by national engineering organizations interacting directly with the field to assist with complex restorations and problem resolution. Typically, this type of support or technical engineering complexity is highly specialized and best suited for accomplishment at the National level. It is imperative that this level of support:

- Provide advanced technical support for complex outage restoration, facility modifications, optimizations, and new installations.
- Is a nation-wide technical and engineering resource.
- Is the ultimate source and authority for all technical support and expertise.

6.5 Operations Support

Operations Support for the field organization includes many non-core functions related to facility improvement and equipment performance. It applies to facilities where hardware and software functionality are normal, however performance trends indicate a need for service improvement. Operations support organizations provide for the continuing need to sustain and upgrade facility infrastructure to counteract progressive deterioration. Operations support services must be responsive and readily available to the field on a real-time basis.

6.5.1 Operations Engineering

Operations engineering is an essential part of Service Area's support for the field. It includes engineering support activities such as siting problems, airspace analysis (e.g., obstructions), performance analysis (e.g., propagation and multipath), large-scope facility refurbishments,

design of local modifications, preparation of technical documentation, statistical analysis of facility technical performance (e.g., radar beacon reinforcement rates, etc.), heating/ventilation/air conditioning design, signal-in-space optimization, investigation of airborne measurement problems, Radio Frequency Interference (RFI) analysis and problem solving, environmental "due-diligence" compliance, and correction of technical problems identified by the maintenance program beyond the scope of field personnel activities. These are functions requiring the application of sound engineering principles and models across multiple engineering disciplines (i.e., civil, mechanical, electrical, electronic). Service Area engineering functions typically differ from those at the national level due to the local or site specific nature of the anomalies.

6.5.2 Program Management Activities

These activities focus on programmatic functions such as tracking of maintenance and modification accomplishments, long-term equipment performance analysis, Non-Fed program, etc. These and other non-core activities such as quality assurance, fiscal, logistics, human resource/staffing, safety, security, automation, training, and labor management relations are functions that will be accomplished by administrative personnel either locally or at the Service Area office or Headquarters.

7. Control Centers

Services provided to internal users and external customers will be managed under a centralized management strategy through a Control Center (CC) concept. Currently, there are three levels of Service Control Centers: the National Operations Control Center (NOCC), the Operations Control Centers (OCC) and the Systems Operations Centers (SOC). The CCs will provide the following primary functions:

- Managing and reporting the status of the NAS
- Upward Reporting
- Communicating information
- Performing periodic service certifications (SOC)

7.1 Managing and Reporting the Status of the NAS

This concept emphasizes the CCs role of managing the NAS. The focus of this approach is to primarily monitor the health of the NAS and take immediate action when abnormalities are detected in order to maximize availability, minimize costs, and reduce equipment caused delays.

In order to manage the health of the NAS and mitigate problems, the CCs will utilize Remote Monitoring and Control (RMC). RMC allows the CCs to perform remote diagnostics and remote corrective actions such as resetting equipment,

changing channels, and part failure identification to allow for better logistic support by responding field personnel. Additionally, by utilizing RMC the Control Centers will ensure better response to problems in the environmental infrastructure such as commercial power, temperature, security, etc.

7.2 Upward Reporting

The Control Centers will be responsible for situational awareness of the NAS within their area of responsibility (AOR). Using this situational awareness, the Control Centers will keep decision makers and upper management aware of NAS anomalies that are, or have the potential of causing impact to operators and users of the NAS.

7.3 Communicating Information

One of the most critical functions of the CCs is to provide field personnel with the information and support they need to maintain the NAS. This includes providing an interface to customers, providing top-level coordination, distributing status information, and prioritizing and coordinating maintenance activities.

7.4 Performing Service Certifications

The following section defines an event-based system and subsystem certification approach. As we transition to this approach, service certifications will become an important QC component. The intent is to have service certifications performed regularly (i.e., periodic). The expectation is that existing service certifications at terminal and en route service delivery points (SDP) will remain the responsibility of that SDP. Service certifications that comprise a large geographic area crossing SSC or SA boundaries or system services (e.g., Terminal Navigation Instrument Approach Procedures -TNIAP) will be further developed and eventually certified.

8. Service, System, and Subsystem Certification

Certification is the quality control method used to ensure facilities are providing their advertised service. Certification is also a regulatory function requiring independent discretionary judgment about the provision of advertised services, separating profit motivations from operational decisions and minimizing liability.

Current policy defines a certification hierarchy of 3 levels – subsystem, system, and service. In general, certifications are performed on a scheduled basis and when required by certain events, such as aircraft accidents or a restoration that necessitated certain maintenance activities. As systems and subsystems are modernized, the maintenance intervals often become longer than the certification intervals, and this tends to decouple the certification judgment from immediate, first-hand knowledge of equipment performance. Under the current certification program, a maximum time interval between certifications is defined, and certifications must be performed by credentialed individuals and documented by explicitly designated log entries.

8.1 System and Subsystem Certification

A significant percentage of the certification program is centered on the scheduling of system and subsystem certification (e.g., weekly monthly, quarterly, etc.). The remaining percent can be attributed to other factors (e.g., maintenance activities affecting a certification parameter). The concept of an event-based approach is founded on certification being a judgment of instant conditions. There is no correlation between a certification effort and its effective "lifetime", except by policy declaration in the form of a maximum certification interval.

A revised subsystem and system certification approach adopts an event-based concept (i.e., certifications will be performed for prescribed events)[1]. The concept of a maximum certification interval, the administrative aspects of tracking their accomplishment, and any uncertainty as to whether certifications are required for a particular maintenance activity will no longer be necessary. *It is important to understand that any attempt at an event-based approach is separate and apart from RCM, which is specific to maintenance.* The transition to event-based certification will run parallel with the integration of RCM as a viable and effective method of operation. Adopting event-based certification will not diminish the scope or level of prescribed maintenance, standards, and tolerances for equipment/systems, nor will it limit the ability of a system specialist to provide an independent certification determination or judgment about the quality and scope of advertised services. An event-based approach does not preclude certifying more frequently than the minimum requirements listed above.

8.2 Service Certifications

Services are the end product provided to the internal users and external customers. Services are rarely interrupted due to redundancies in the NAS architecture. When a service is affected, the typical result is a *reduced* level of service. Certifying NAS services ensures the requirements of our customers are met.

A standardized services naming convention incorporating airspace and technical discipline as related to the NAS is being studied (i.e., service delivery model). The structure of this convention is principally suited for assisting customers to readily understand NAS services, the contributing systems comprising those services, and potential use in a fee-for-service environment.

Appropriate specialist training and credentialing is necessary to meet the expectation for certifying services. It is important to note that service certifications will remain as a periodic activity in order to encompass the complete scope of advertised services provided by systems and subsystems.

[1] Examples are provided in Appendix 2

8.3 Certification Documentation

Validation of the certification judgment is currently documented by logging of an explicit certification statement, generally unique to the facility/equipment type. This is a stand-alone log entry, independent of related maintenance and restoration activity log entries. A large administrative burden accompanies the uniqueness of each certification statement due to management and tracking of the logging system databases and oversight by technical evaluation personnel.

Nearly all of this burden can be eliminated by creating a new, common certification statement usable for all certifications, regardless of facility type. An example of this would be “certified, return to service” (e.g., ABC VOR CRTS), which would indicate that a certification judgment had been made as part of a restoration process. Combined with the proposal to centralize the entry of logging statements, this change will nearly eliminate the time-consuming administrative activities currently associated with certification accomplishment documentation.

9. Employee Credentialing and Proficiency

The Airway Transportation Systems Specialist (ATSS) credentialing program must ensure traceability, promote personnel proficiency, and maintain the integrity and credibility of the process. Time gaps between theory of operations training, hands-on experience, and demonstration of initial proficiency should be minimal in order to provide a continuum of knowledge transfer. The FAA Academy will provide a learning experience that closely simulates the field environment and concentrates on maintenance work practices and troubleshooting techniques to the maximum extent possible.

9.1 Technical Specialists Development and Credentialing

The four existing steps of the current technical specialist credentialing process shall remain. They are: *theory-of-operations training, hands-on experience, practical demonstration of proficiency,* and *attaining certification authority.*

Theory-of-operations training requirements, normally accomplished by resident training at the FAA Academy, will incorporate knowledge and skills of equipment operation, work practices (e.g., use of maintenance handbooks, technical documentation, etc.), and troubleshooting techniques. The role of the FAA Academy will be expanded to provide the technical specialist with an opportunity to practice and demonstrate skills and techniques in an *enhanced hands-on training* environment. Practical exercises will include performance of handbook maintenance tasks and measurement of critical performance parameters. This integrated approach to technical training is designed to bring technical specialists to a higher level of proficiency and prepare them to return to the work center ready to assume maintenance responsibilities.

A *practical demonstration of technical proficiency*, the equivalent of a field conducted Performance Examination (PE), will be administered to each technical specialist at the FAA Academy. The technical specialist returns to the work center having demonstrated technical proficiency, work practices, troubleshooting techniques, and knowledge of certification procedures. Legacy equipment will continue to require field conducted on-the-job training and PE as a demonstration and measurement of performance and proficiency.

The final phase of the personnel certification process includes a *first-level supervisory endorsement* that the specialist has the *capability* of performing prescribed maintenance and certification activities. This includes site familiarization, coordination procedures, practice in technical documentation, and knowledge of risk management procedures.

Upon the completion of all phases of the credentialing process, an entry will be made to an automated system followed by the issuance of a certification credential to the technical specialist.

Objectives of the technical specialist development and credentialing process are:

- Eliminating time gaps and burdensome administrative processes inherent in each phase of the technical specialist credentialing process
- Allowing the technical specialist to attain and apply technical skill and knowledge as a continuous systemic process
- Enhancing and standardizing the theory-of-operations, hands-on learning, and demonstration of proficiency experience for the technical specialist
- Focusing the FAA Academy on providing a learning experience that closely simulates the field work environment
- Increasing availability while reducing risk to NAS systems, subsystems, equipment and services by eliminating their use as a hands-on training venue

9.2 Certification Responsibility and Workload Assignment

Certification authority credentials will enable technical specialists to perform maintenance and certification activities on all like facilities (i.e., by Facility Identification Code-FIC) regardless of location. This eliminates the need for the Responsibility Assignment (FAA form 3400-5) phase of the certification process and:

- Eliminates administrative workload associated with maintaining, reviewing, revising, distributing and file maintenance of Responsibility Assignment, FAA Form 3400-5 and supporting documentation
- Increases the versatility of technical specialists to utilize their certification authority across geographical or organizational boundaries

- Transfers maintenance and certification enabling authority to Certification Authority, FAA Form 3400-3
- Allows the Facility Authorization Record (AFA) within the MMS program to remain unchanged

The first-level manager will use a standardized automated system (e.g., Comprehensive Management Resource Information System, CMRIS) to communicate assignment of workload to the individual technical specialist. This process will clarify primary and secondary workload assignments. The documentation associated with assignment of workload will be completed and maintained at the System Support Center (SSC).

9.3 Technical Specialist Proficiency

Following the technical specialist development and credentialing process, the traditional means for maintaining technical proficiency typically involves recurring on-the-job work experiences (e.g., periodic and corrective maintenance, bench repairs, facility optimizations, etc.). Formal refresher training at the FAA Academy has not existed, short of repeating the initial formal classroom theory-of-operations training. Facility "workshops" and technical seminars provide a venue for advanced learning and recurring hands-on training opportunities.

Credentialed technical specialists must maintain and be able to demonstrate their proficiency on a recurring basis. The first-level manager has direct oversight in assuring that each technical specialist maintains technical proficiency and is capable of performing maintenance, certification, and restoration activities. This direct oversight of NAS maintenance activities also allows the technical specialist and manager an opportunity to interface on problem areas that inhibit optimum accomplishment of maintenance or restoration tasks. Review by the first-level manager will continue to result in annual documentation of technical proficiency and capability. Should the specialist be unable to demonstrate technical proficiency, remedial actions tailored to the individual needs of the specialist will be initiated.

10. Remote Monitoring and Control (RMC)

Remote Monitoring and Control (RMC) is a maintenance tool that provides continuous NAS equipment status plus the ability for performing preventive and corrective maintenance along with system analysis from locations other than the remote site. This performance shift will not only reduce restoration time and improve customer satisfaction, but also reduce the cost of maintaining the systems. Through this tool users can remotely reset, re-configure, and change operating parameters on NAS equipment. RMC also provides equipment performance and historical data and the ability to perform maintenance tasks remotely. RMC is expected to be the primary method for monitor and control activities, and the initial method used for restoration efforts. RMC will enhance

the ability of field specialist to monitor and respond to problems in its environmental infrastructure (e.g., commercial power, temperature, and security).

10.1 RMC Utilization Strategy

Technical specialists will utilize RMC to reduce the number of remote site visits, improve situational awareness of the NAS infrastructure (which includes awareness of environmental conditions), and allow for a quick response to NAS equipment problems.

Business cases will be developed to identify which systems should utilize RMC. Also, periodic equipment maintenance that can be accomplished remotely will be identified. The business cases will take into account that for a given system type, the location of the system may determine if a system/location should be monitored (e.g., staffed vs. non-staffed facilities).

RMC utilization will be structured to support its use by various levels of the organization. CCs can utilize RMC to monitor and control systems on a 24/7 basis. RMC can be used at determined control points to optimize NAS systems performance, availability, and to provide status to users. The data points monitored should be those that are deemed mission critical or mission essential. CCs can utilize restoration commands (e.g., reset, recycle, and restart) as appropriate in an effort to restore systems or redundant elements to service.

By implementing RMC, work centers (WC) can perform routine checks remotely to provide an operational snapshot, thus reducing the number of site visits. Once advised of equipment or facility problems, specialists can respond quickly from remote locations to restore the system to service by exercising restoration commands or changing parameters. The diagnostic capability of RMC will allow the specialist to better prepare to address the outage by bringing the proper resources (i.e. circuit cards, test equipment, etc.) to the remote site. This will minimize equipment down time and impacts to the customer.

10.2 Legacy Systems

Legacy systems without RMC capability will be analyzed to determine if COTS products could make them RMC capable.

10.3 Future Acquisitions

RMC requirements will be identified and incorporated in the system specifications of future acquisitions. This will include identifying RMC users and their requirements so that their specific needs are supported. The total amount of data provided from a system by RMC will be determined by a succinct set of requirements. Additionally, RMC connectivity requirements must be supported for new acquisitions.

10.4 Virtual Collaboration

Remote communications with our workforce has grown from using solely private radio communication to include major use of the public networks (i.e. cellular phones and two-way paging). This has grown with wide-spread development and distribution to provide coverage to almost all facilities in the NAS. Usually this is not single coverage but coverage by multiple carriers in areas of our dense traffic. This has provided the organization an available, redundant, public network in areas failures would have the greatest impact and where natural disasters would have equal effect.

Virtual Collaboration represents a means of leveraging existing and developing technology to bring intellectual capital to a site on an ad hoc and as needed basis to instantly collaborate for problem resolution. Through the use of off-the-shelf technology, specialists will be able to communicate with visual images. Virtual Collaboration costs are negligible, and can yield cost avoidance in many areas.

Through the use of the same technology, specialists can react to extraordinary circumstances that affect the NAS. These circumstances affect large numbers of NAS facilities and are above and beyond normal NAS restorations. This virtual and geographically diverse network can provide more efficient assessment and response to natural events.

11. Metrics

Metrics for measuring performance will fall into two categories, external and internal. External metrics are those that have been used to measure the performance of NAS equipment or NAS services. These metrics are recognized by ATO owners, customers, and other Lines of Business (LOB) as indicators of NAS performance. ATO-W will continue to collect and publish data related to external metrics for the ATO however, ATO-W is not the sole owner of external metrics. Internal metrics specific to ATO-W, in contrast, will be used to assure the Service Areas meet their part of the recognized external metric and provide specific evidence of compliance with SLAs.

11.1 External Metrics

Historically, metrics such as facility availability, equipment related delays, and maintenance costs have always been owned by the organization responsible for maintenance of the equipment (i.e., ATO-W). Since the advent of the ATO and creation of the Terminal, En Route, and Flight Services organizations, ATO-W now has partners in these metrics.

As an example, Figure 1 illustrates the various components contributing to availability. Failure rates and maintainability are inherent qualities determined by the requirements of organizations procuring systems and services. Site location, infrastructure quality, and number of spare parts are specific to site attributes. How soon repairs begin on a failed system will be a collaborative determination (e.g., based on criticality) of the procuring organization, user, and ATO-W.

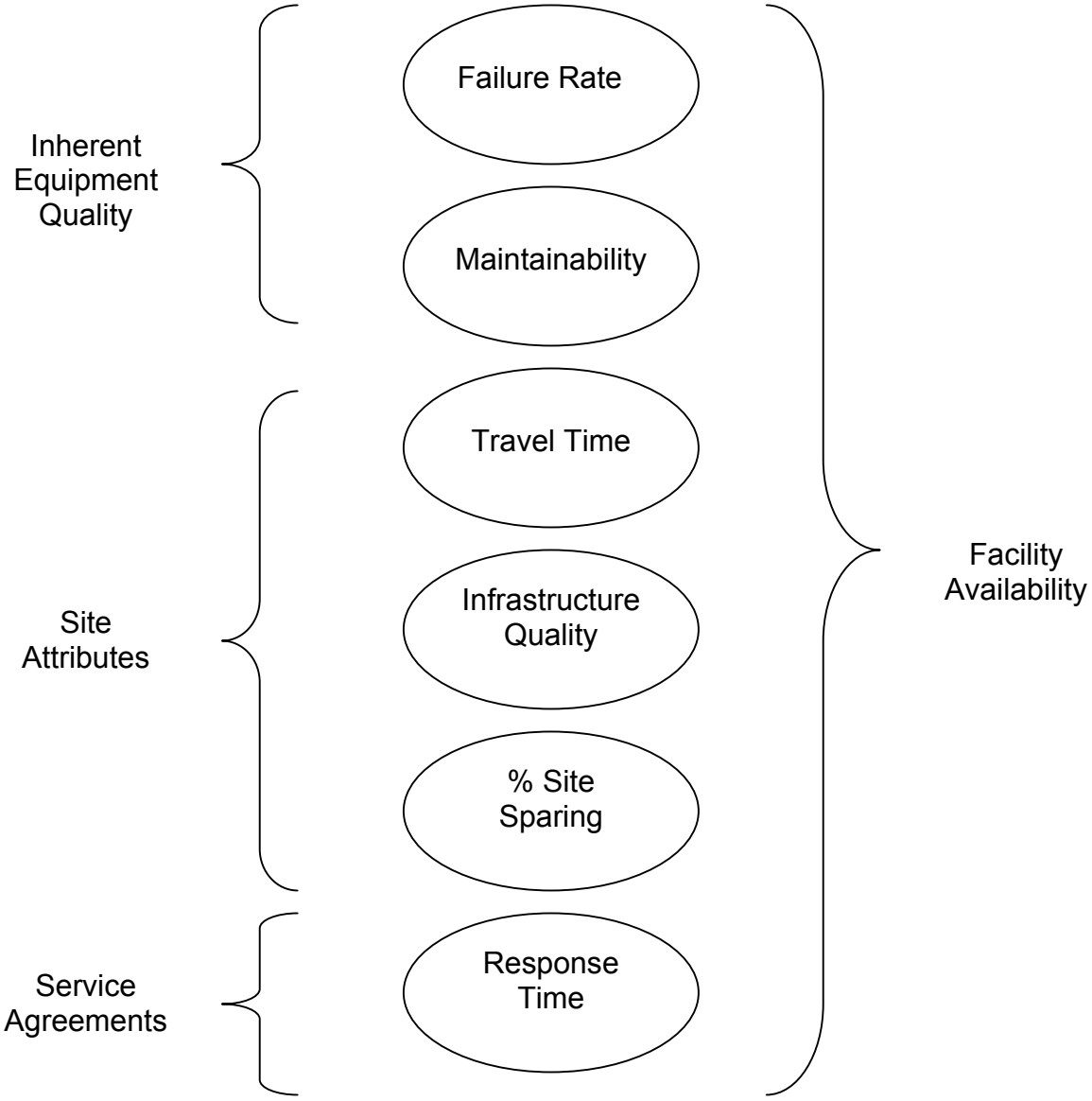

Figure 1 - Contributions to Availability

It is important that ATO continues to use these metrics, with corporate accountability as a primary goal. ATO-W will continue to collect the data, though the responsibility should not reside solely at the field level.

11.2 Internal Metrics

As mentioned previously, measurement targets that were historically owned by the Field Services organization are now shared. Retaining the old metrics of measuring SSCs equally prevented a prioritization of response to system anomalies across the NAS. Examples of some internal metrics at the field level are:

- Responding in the agreed upon time 90% of the occasions. The specialist is expected on site to commence repair within the agreed upon period. Immediate response category implies skilled presence on site.
- Performing work within allocated budget.
- Performing all work and procedures required in maintenance handbooks. Proper maintenance procedures will be evaluated by review of logs generated by the specialist and validated and reviewed by work center management. NAS Technical Evaluation Program (NASTEP) provides final quality and safety assurance.
- Mitigating risk by performing maintenance when traffic is below critical levels. The scheduled work threshold level is agreed upon (i.e., negotiated) with the local air traffic management.

Internal metrics are essential for encouraging and driving managers to provide an expected level of service at the lowest cost and in accordance with published agency requirements. It is imperative to provide managers with a set of tools for tracking these metrics.

Appendix 1

Executive Summary of Significant Changes

This chart contrasts the significant differences conveyed in this document between Technical Operations and its predecessor, Airway Facilities.

	Airway Facilities (Current Operations)	**Technical Operations** (Future Operations)
Maintenance Planning	Cost benefit not a prime consideration for delivery of NAS Services Periodic approach for all actions i.e., Limited predictive analysis used to determine maintenance approach	Cost benefit and customer needs are prime considerations for delivery of NAS Services Reliability Centered Maintenance (RCM): based on engineering analysis of equipment and LRU failures, maintenance action will be planned 1. Event-dependent for inherently reliable systems (e.g., digital) 2. Periodic maintenance for older or mechanical systems (e.g., HVAC)
Corrective Maintenance	Restoration influenced by availability and reliability performance metrics without regard to NAS contribution	Tiered restoration emphasizing facility criticality, value, customer need, and cost

	Airway Facilities (Current Operations)	**Technical Operations** (Future Operations)
Workforce Structure	Maintenance program consists of three tiers: 2101 technical specialist, Technical Support, and Control Center	Maintenance program consists of four tiers: Trades and Skilled labor, 2101 technical specialist, Technical Support, and Control Center
	SSC field level specialists spend considerable time on non-technical activities	Non-technical activities are transferred to the SA and Control Centers
	Technical program management shared between SMO and RO	*All* technical program management functions reside exclusively at the SA
	Regional/SMO technical support shared and does not support all technical specialties	Eliminate technical support from the SA, and enhance Technical Services (TS) support for all technical specialties
	Operations Engineering part of some SMOs .	Operations Engineering managed by the Engineering Service (ES) must focus on support of field activities

	Airway Facilities (Current Operations)	**Technical Operations** (Future Operations)
Control Centers	Maintain and monitor various aspects of the NAS	Manage the availability of the NAS
		SOCs perform Service level certifications on a periodic basis
		RCM eliminates the requirement for remote PM tasks
	Perform limited logging and event ticketing	Investigate efficiencies for logging and event ticketing
Certification of Systems (equipment) and Services	Periodic certification accomplished on-site for all systems (equipment) and *Services*	Periodic *Service* certification accomplished by SOCs
	Event-based certification for commissioning, some restorations, and sometimes post-accident (three events)	Solely an event-based (expanded beyond three events) system certification accomplished on-site by technical specialist
	Set of five criteria used for determining certification requirements	Reevaluate criteria used for determining system (equipment) certification requirements

	Airway Facilities (Current Operations)	**Technical Operations** (Future Operations)
Employee Credentialing and Proficiency	FAA Academy training does not simulate field work environment	Integrated Academy training includes enhanced hands-on equipment training
	OJT and performance exam (PE) must be administered by the SMO	Demonstration of proficiency is conducted at the FAA Academy
	SMO administers certification authority and facility responsibility assignment programs	SA issues ATSS credentials Facility responsibility assignment (3400-5) requirement eliminated
	ATSS proficiency issues exist	Increase first-level supervisor technical proficiency oversight role. Additional tools and training options provided

	Airway Facilities (Current Operations)	**Technical Operations** (Future Operations)
Remote Monitor Control (RMC)	Expectation is for every system fielded to include RMM capability	RMC where we can make a business case
	Requirements call for every remote monitoring of every data point	Parameters that are monitored should reduce site visits, or provide assistance in corrective maintenance – must add value
	Communications network primarily used for voice communication	Use communications network for voice and data to provide virtual collaboration
Metrics	Equipment reliability and availability emphasized	Metrics include adjusted availability, equipment related delays, mean time to respond (MTTr), and facility costs
	Criticality of facility not factored into metric. Cost neither captured nor correlated to performance	Criticality of facility will be factored into metric
	Limited correlation between equipment outages and impact to customer	Metrics will drive discussion between Technical Operations and customer. Specific focus to response time, equipment architecture, etc., and their associated costs

Appendix 2

Events Requiring Certification

This document discusses an event-based approach specific to system and subsystem certifications. This list exemplifies the occasions where certification is required.

- An interruption or outage caused by or changing a certification parameter.

  Note: *Re-certification is not required when a facility with internal monitoring and auto-reset or operator-initiated reset returns to service, and no other action other than the reset was taken.*

- Following any flight inspection where recertification is needed.
- Modifications or maintenance requiring adjustment of key or certification parameters.
- Reconfigurations or updates that change user interfaces (e.g., displays) or output (e.g., reports, flight plans) characteristics.

  Note: *Reconfigurations that swap hardware from primary to backup, place standby/offline equipment online, or change channels on an operational system do not require certification. Updates specific to maintenance personnel interfaces or output characteristics do not require certification.*

- Pilot reports (two or more from separate aircraft) navigational aid malfunctions where the integrity of the radiated signal is in question.

  Note: *This does not include system resets where the system was found off the air and then returned to service.*

- Restoration where certification was removed due to system degradation.
- Prior to commissioning.
- Following aircraft accident/incidents if directed by the AFFAR.
- Situations where the specialist's determination is that the advertised service of the system or subsystem is suspect.

Appendix 3

Definitions

Aperiodic – Occurring irregularly: not recurrent or without periodicity.

Business Process(es**)** – A structured activity or collection of structured activities (e.g., a chain of events) that produce a specific service or product for a particular customer or customers.

Concept of Operations – A document, in broad outline, of an organization's assumptions and intent with regard to execution of current and future business processes. A document designed to provide only the high level description of specific operations.

Field Work – Efforts that include the management or accomplishment of core functions (i.e., certification, logging, maintenance, modifications, and technical documentation, etc.).

Holistic – Emphasizing the importance of the whole and the interdependence of its parts.

National Airspace System (NAS) infrastructure – The physical components of the NAS. This includes systems, facilities, leased service, support services, inventory, vehicles, and real estate.

National Airspace System (NAS) user **–** Categorized as internal and external: internal users are air traffic controllers and external users (i.e., customers) are any entities that rely on Air Traffic Organization (ATO) services as part of their daily business.

Service Delivery Point – A manned air traffic control facility where Air Traffic Control personnel provide NAS services (i.e., ARTCC, CERAP, ATCT, TRACON, (A)FSS facilities as well as the ATCSCC).

Situational Awareness – Refers to the degree of accuracy in which information can be instantaneously obtained and acted upon (and disseminated if necessary).

Technical Specialist – Field level personnel that manage or accomplish Tech Ops core functions.

Work Practices – Activities relating to the successful accomplishment and performance of prescribed maintenance and certification activities. This includes site familiarization, coordination procedures, practice in technical documentation, and knowledge of risk management procedures.

NOTES